

## Description

### ROTARY SWITCH

#### CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a continuation patent application of International Application No. PCT/SE02/01790 filed 1 October 2002 which was published in English pursuant to Article 21(2) of the Patent Cooperation Treaty, and which claims priority to Swedish Application No. 0103420-6 filed 15 October 2001. Both applications are expressly incorporated herein by reference in their entireties.

#### BACKGROUND OF INVENTION

#### TECHNICAL FIELD

[0002] The present invention relates to a rotary switch for vehicles having a plurality of rotational positions for operating a plurality of different lighting groups and several spring-loaded axial positions for operating several different lighting groups, as well as a method for controlling electronic functions in vehicles utilizing such a switch.

## BACKGROUND ART

- [0003] In modern vehicles there are many functions that are controlled electronically. Some of these functions are of the on/off type and require no other control than a simple switch, for example certain light functions. Some functions, however, can be switched to several positions, for example windscreen wipers. The control of these functions is carried out using some form of switch with several positions. A switch can either be a full-load switch, where the load is connected directly to the switch, or a low-level switch, where the load is connected to a power unit, for example a relay, which is controlled by the switch.
- [0004] A problem with having many electronic functions and hence many switches, is that the location of the switches can easily become confusing. Another problem is that the switches should be located within easy reach of the driver. This can be a disadvantage, particularly in trucks and busses that usually have many more switches than automobiles. In addition, for the sake of driver clarity, it is desirable to have all the switches that control the same type of function collected in a defined group.
- [0005] A common way of limiting the number of switches is to use multi-function switches or multi-function modules;

for example, all light functions on a vehicle can be controlled by one switch or by a module in which the switches for controlling the light functions are integrated.

- [0006] A rotary switch that is known to the skilled person in the field has three rotational positions; the first position denoting switched-off lights, the second position denoting parking lights and the third position denoting full/dipped beam of the headlamps. In addition, this switch has two pulled-out positions for fog lamps, by which the front and rear fog lamps are controlled. The pulled-out positions are controlled mechanically in such a way that the fog lamps can only be activated in the third rotational position. When the rotary switch is turned towards the first position, the fog lamps are deactivated.
- [0007] A disadvantage of this type of switch is that it is expensive and complicated to achieve the mechanical control for the pulled-out positions. In addition, several different versions of the switch are required to cover the different combinations of possible functions that are required. Another disadvantage is that front and rear fog lamps cannot be controlled individually. A further disadvantage is that the pulled-out positions of the switch are not reset automatically when the vehicle's engine is switched off. De-

pending upon how the fog lamp function is implemented, this can mean that the driver can inadvertently leave the fog lamps switched on or that the driver can believe that the fog lamps are activated when they are actually switched off. In addition, there can be legal requirements for the fog lamp function to be deactivated when the vehicle's engine is started up.

- [0008] Similar rotary light switches with one or more pulled-out positions are described in, for example, WO 00/48215, US 5546067, US 4164633, US 5491311, US 4885434 and EP 0342031.
- [0009] Another rotary switch that is known to experts in the field has a similar function with rotational positions and two pulled-out positions for fog lamps. This switch has an electromagnet that holds fast a spring-loaded control element in the pulled-out positions of the switch. When the vehicle's engine is switched off or when the rotary switch is turned towards the zero position, the electromagnet releases the control element that returns to its normal position.
- [0010] Disadvantages of this switch are that it is expensive and complicated. Several different versions of the switch are also required for this switch to cover the different combi-

nations of possible functions that are required. Another disadvantage is that front and rear fog lamps cannot be controlled individually.

- [0011] A third way of solving the problem of lack of space and clarity is to arrange a rotary switch with a number of two-way switches in a module. Examples of this solution are described in, for example, US 5773935, US 5736696, US 6034337 and US 5281779.

## SUMMARY OF INVENTION

- [0012] An object of the invention is to achieve a rotary switch, which in one version makes possible a plurality of axial functions, and a method for activating different electronic functions in as logical a way as possible.
- [0013] Regarding the instant rotary switch for vehicles that includes a number of rotational positions and at least one axial position, an object of the invention is achieved by at least one axial position being spring-loaded. The method according to the invention for controlling a plurality of electronic functions by means of a spring-loaded rotary switch solves the problem by a first function being activated by a first pushing movement and a second function being activated by a first pulling movement.
- [0014] According to this first embodiment of the inventive rotary

switch, a rotary switch is obtained with at least one axial momentary function option. The advantage of such a rotary switch is that it is possible to control electronic functions on a vehicle in a flexible and logical way.

- [0015] In an advantageous first further development of the system according to the invention, the axial position is activated by a pushing movement or by a pulling movement. The advantage of this is that the activation of the axial function can be logically related to the physical function.
- [0016] In an advantageous second further development of the system according to the invention, a rotary switch is obtained with two axial momentary function options. The advantage of such a rotary switch is that it is possible to control electronic functions on a vehicle in a flexible and logical way.
- [0017] A method according to the invention for controlling a plurality of electronic functions by means of a spring-loaded rotary switch comprises (includes, but is not limited to) steps of activating a first function by a first pushing movement and of activating a second function by a first pulling movement. The advantage of this method is that it is possible to control electronic functions by means of a rotary switch in a simple and logical way.

- [0018] In an advantageous further development of the method of the present invention, the method also comprises the steps of deactivating the first function by a second pushing movement and of deactivating the second function by a second pulling movement. The advantage of this is that the electronic functions can be deactivated either by an operator or automatically by the system without a mechanical return of the rotary switch being required.
- [0019] In another advantageous development of the inventive method, the method also comprises the step of activating a third or fourth function when the rotary switch is pushed in or pulled out a predetermined number of times during a predetermined interval of time. The advantage of this method is that it is possible to control electronic functions by means of a rotary switch in a simple and logical way.
- [0020] In yet another advantageous development of the method performed according to the invention, a step is executed that includes activating a fifth or sixth function when the rotary switch has been pushed in or pulled out for a predetermined interval of time by the first pushing movement or pulling movement, respectively. The advantage of this method is that it is possible to control electronic functions by means of a rotary switch in a simple and logical way.

[0021] In a fourth advantageous development, the method also comprises the step of activating a seventh or eighth function by means of a rotary movement when the rotary switch has been pushed in or pulled out respectively. The similar advantage of this development is that it is possible to control electronic functions by means of a rotary switch in a simple and logical way.

#### **BRIEF DESCRIPTION OF DRAWINGS**

[0022] The invention will be described in greater detail in the following, with reference to the embodiments that are shown in the attached drawing, in which:

[0023] Figure 1 is a schematic view of an exemplary rotary switch configured according to at least one embodiment of the invention.

#### **DETAILED DESCRIPTION**

[0024] The embodiments of the invention, including the several developments described herein are to be regarded only as examples, and in no way limit the scope of protection provided by the patented claims.

[0025] In a first embodiment of a rotary switch 1 configured according to the invention as illustratively shown in Fig. 1, the rotary switch 1 has four rotational positions 3, 4, 5, 6.

The different positions are set by a control element 2 which is turned to the required position. In this embodiment, the rotary switch is used to control the driving light functions; that is, parking lights, dipped/full beam of the headlamps, auxiliary light and fog lamps on a truck or other vehicle. The number of rotational positions of the rotary switch 1 may be varied, and is selected as required. Thus, for example, a rotary switch intended for a bus can have six rotational positions.

- [0026] The light functions on the truck are controlled by a light module. This comprises, among other things, an input stage to which the rotary switch is connected, a control unit which decodes signals from the rotary light switch, and an output stage, for example relays or power semiconductors, which drive the load, in this case lamps. The control unit can comprise a computer, for example a processor with associated peripheral circuits such as a memory unit, to simplify making changes to and upgrading of the light control functions. The outputs of the light module can either be stable, that is an output is activated when a contact in the rotary switch is activated, or bistable, that is an output changes state each time a contact in the rotary switch is activated.

- [0027] In this example, the rotary switch comprises only the switch element and no logic functions. It is also possible for the rotary switch to comprise a control unit and a memory unit that codes the signals. The light module will then comprise only the drive stage to the loads. The connection of the rotary switch to the light module can either be parallel or serial.
- [0028] Position 3 of the rotary switch is a zero position in which all lights are switched off. For certain markets, the zero position can denote that a day running lamp function is activated when the vehicle is running. Position 4 is a parking position in which the parking lights are activated. Position 5 is a driving-light position in which full/dipped beam of the headlamps is activated. Position 6 is an auxiliary light position in which an auxiliary headlamp, for example long-distance beam, is activated when the full beam function is activated.
- [0029] In addition, the rotary switch has two axial positions. These positions are used in this example to control the fog lamps on a truck. One position, here called the pushed-in position, is obtained by the control element being pushed in. When the control element is pushed in, a contact in the rotary switch sends a signal to the light

module that means that an output is to be activated. In this example, this output drives the front fog lamps. The control element is spring-loaded so that it returns to its normal position in the axial direction when the control element is released. This means that the signal that is sent to the light module is momentary.

- [0030] The second position, here called the pulled-out position, is obtained when the control element is pulled out. When the control element is pulled out, a contact in the rotary switch sends a signal to the control unit that means that an output is to be activated. In this example, this output drives the rear fog lamps. The control element is spring-loaded so that it returns to its normal position in the axial direction when the control element is released. This means that the signal that is sent to the light module is momentary. The control element is advantageously designed so that its surface provides a good grip for being pulled out.
- [0031] It is advantageous that attention is paid to the position of the rotary switch when the axial positions are to be activated. When the axial positions are used to control fog lamps, legal requirements in different countries can affect the circumstances in which fog lamps are able to be acti-

vated. For example, the front fog lamps must only be able to be activated in positions 4 and 5 of the control element. Thus, if the control element is in position 3 when the pushed-in position is activated, the light module can prevent the front fog lamps from being activated using a memory unit in which permitted combinations are stored.

- [0032] The deactivation of the fog lamps can be carried out in various ways. As the axial positions of the rotary switch are spring-loaded, the outputs that are activated in these cases are bistable. The deactivation of an output is consequently carried out by carrying out the activation routine once more. The deactivation of, for example, the front fog lamps is carried out by pushing in the control element when the front fog lamps are activated. The output changes state each time the control element is pushed in.
- [0033] Another way of deactivating the fog lamps is to turn the rotary light switch. If the rotary switch is turned to a position in which the fog lamps are not to be activated, the light module can deactivate the output that drives the fog lamps in question.
- [0034] A third way of deactivating the fog lamps is to switch off the vehicle's engine. The outputs that drive the fog lamps can then be reset so that they are not activated the next

time the vehicle's engine is started up. This is advantageous as the fog lamps cannot be left inadvertently in an activated state.

- [0035] In those cases where the rotary switch is used for other functions than fog lamps, it is, of course, also possible to use a memory to memorize the state of the outputs when the vehicle's engine is switched off. This means that the outputs can be reactivated when the vehicle's engine is started up. An example of a function where this can be advantageous is, for example, heated mirrors.
- [0036] As the control element is spring-loaded and the output that is controlled by an axial position has alternating states, it is advantageous to indicate the state of the output in such a way that the driver can easily see the state of the output. This is carried out most simply by illuminating a symbol located in a suitable position. In this embodiment, symbols 7, 8 are used to show the state of the outputs. The symbol is lit when the corresponding output is activated and extinguished when the output is deactivated. Here the symbol 7 indicates that the front fog lamps are activated and the symbol 8 indicates that the rear fog lamps are activated. The indication of the state of an output can also be carried out in another way. For ex-

ample, a symbol representing the state of the output can be displayed in a character window in, for example, the vehicle's instrument panel. Where and how an indication is made can be controlled by legal requirements.

- [0037] In a first embodiment of the method according to the invention for controlling a plurality of electronic functions by means of a spring-loaded rotary switch, the steps are included of activating a first function by means of a first pushing movement and of activating a second function by means of a first pulling movement. The first function is activated by pushing in the control element of the rotary switch. The second function is activated by pulling out the control element of the rotary switch. The control element of the rotary switch is spring-loaded so that it is normally in an intermediate position.
- [0038] For example, the first function can be front fog lamps on a truck. When the control element is pushed in, the output is activated that drives the front fog lamps. The second function can be, for example, rear fog lamps on a truck. When the control element is pulled out, the output is activated that drives the rear fog lamps. The control element is spring-loaded so that it returns to its normal position in the axial direction when the control element is released.

- [0039] As the axial positions of the rotary switch are spring-loaded, the outputs that are activated in these cases are bistable. This means that the outputs change state each time the control signal that controls the output is activated. The deactivation of a function is consequently carried out by carrying out the activation routine once more.
- [0040] For example, the front fog lamps are deactivated by pushing in the control element when the front fog lamps are activated. As the output changes state each time the control element is pushed in, the front fog lamps are activated/deactivated each time the control element is pushed in. In the same way, the rear fog lamps are activated/deactivated. When the control element is pulled out when the rear fog lamps are activated, the rear fog lamps are deactivated. Next time the control element is pulled out, the rear fog lamps are activated again.
- [0041] The functions that are controlled by the axial positions do not need to be fog lamps. For example, these positions can be used to control the functions "headlamp interrupt" and "marker interrupt". These functions are common in certain markets. The function "headlamp interrupt" means that the driving lights are extinguished when the control element is pushed in. The function "marker interrupt"

means that the position lights on the vehicle is extinguished when the control element is pulled out. In these cases, the outputs are not alternating but are mono-stable. Other functions for which the rotary switch according to the invention can be used are sign illumination, plough lighting, lateral lights, fifth wheel illumination or additional reversing lights.

- [0042] In an additional development of the method of the invention, a third or fourth function can be activated when the rotary switch is pushed in or pulled out a number of times within an interval of time. For example, the third function can be activated when the control element is pushed in twice within one second. The deactivation of this function can be carried out by pushing in the control element a number of times within an interval of time. For example, the third function can be deactivated when the control element is pushed in twice within one second. An example of such a third function can, for example, be that the front fog lamps are not deactivated when the vehicle's engine is switched off. This can be advantageous, for example, for a delivery vehicle that stops frequently and where the driver wants to have the front fog lamps on when the vehicle is running. The indication that the function is active can be

carried out by an illuminated symbol.

- [0043] In a second development of the method according to the invention, a fifth or sixth function can be activated when the rotary switch is pushed in or pulled out respectively for a predetermined period of time. In this further development, a predetermined period of time is stored in the memory unit. When the control element is pushed in or pulled out, the control unit counts the time during which the control element is operated. If the operating time is longer than the predetermined period of time, a fifth or sixth function is activated. An example of such a fifth function can, for example, be that the front fog lamp is not deactivated when the vehicle's engine is switched off. This can be advantageous, for example, for a delivery vehicle that stops frequently and where the driver wants to have the front fog lamps on the whole time. The deactivation of this function can be carried out by holding the control element pushed in for the predetermined period of time once again. The indication that the function is active can be carried out by an illuminated symbol.
- [0044] In a third development of the method of the present invention, a seventh or eighth function can be activated when the control element is pushed in or pulled out re-

spectively at the same time as the control element is turned to a particular position. In this further development, the control unit detects that the control element is pushed in or pulled out at the same time as the control element is turned to a particular position. The control unit can detect either from which position the control element is turned, to which position the control element is turned or in which direction the control element is turned. Dependent upon what conditions have been stored in the memory unit, a seventh or eighth function is activated. An example of such a seventh function can, for example, be that the front fog lamp is to be activated constantly when the vehicle is running if the vehicle has not been stopped for more than a predetermined waiting time, for example one hour. This can be advantageous, for example, for a delivery vehicle that stops frequently and where the driver wants to have the front fog lamps switched on throughout the whole of his shift. When his shift is finished and the vehicle is parked, the waiting time will be more than one hour, which means that when his next shift starts the front fog lamps are deactivated. The deactivation of this function can be carried out by holding the control element pushed in while at the same time turning the control ele-

ment. The indication that the function is active can be carried out by an illuminated symbol.

[0045] The invention is not to be regarded as being limited to the embodiments described above, a number of additional variants and modifications being possible within the scope of the patented claims. The rotary switch can, for example, also be used for ships, vessels or within industrial automation.